

REMARKS

Applicant notes with appreciation that the Examiner has indicated that claims 123, 128-131, 133, 134, 137, 148, 156, 159 and 161 are allowed. These claims have been renumbered in the present amendment as claims 166, 175-178, 180, 181, 184, 195, 203, 207 and 209, respectively, in order to maintain a consecutive numbering of the claims. Applicant anticipates that the Examiner will continue to hold these claims as allowed.

Applicant objects in most other parts to the Office Action dated August 4, 2003, as the examination was based on misunderstandings. Therefore Applicant respectfully requests that the Examiner review the claims and remarks presented in this amendment. Since Applicant is rewriting the claims as new claims 165-212, a chart is enclosed (**enclosure 3**) which illustrates the differences between these new claims and the claims as they were last examined. A further chart is enclosed (**enclosure 4**) illustrating the differences between the examined claims and the claims as previously presented in the application.

1. Comments on single points in the note:

Concerning point 1:

There was a misunderstanding concerning the groups:

It was assumed that with the submission of new generic claims these would be examined for all inventions. This exception was expressed in Applicant's amendment filed April 17, 2003, page 16, line 4-5.

Apart from that, problems could arise from grouping the inventions into only 16 groups.

In fact there are more than 16 (groups of) inventions in this patent application. Each figure shows aspects of the invention, which also forms an inventive machine together with different construction forms.

The groups which should be examined first (apart from the 16 groups) form the generic claims and relate to the design of the air gap in relation to the air coil in section across the moving direction. This invention is included in several of the 16 groups.

To facilitate the examination Applicant indicated the corresponding group resp. drawing for each claim, in which the invention is shown. (**enclosure 2**)

Applicant put in an application for the generic claims of the new claims for the indicated groups to be examined.

All generic claims are founded on one invention idea, which is based on the ideal conditions being implemented in a highly efficient electrical machine. These ideal conditions are not taken into consideration in their entirety in the development of machines nowadays.

A misunderstanding concerning edge 10:

The examination showed, amongst other points, that there is a misunderstanding concerning edge 10, which could not be cleared up by picture 2 in the **enclosure 1 (attached)**.

This misunderstanding led to a wrong assessment of generic claims 122, 124 and 125 as well as most rejected subordinate claims.

To make things clear the distinction of the aspects of the edge 10 was taken over into the new claims 165-212. According to these claims, edge 10 can have different forms, expressed more clearly: bordering- or corner edge 10 and an outer edge 28. The reference numeral 28 has been added to Figs. 1, 3, 5, 9, and 27 on the amended Figures submitted with this amendment to clarify the area of the edge referred to. The specification has also been amended at appropriate locations to reflect this clarification.

At the **bordering- or corner edge 10** both boundary surfaces belonging to the first body can border at each other directly in two different ways, founding a bordering- or corner edge 28:

1. with the boundary surfaces bordering at each other (jointly), contacting each other and blending into each other, with the contact point in a 180° angle (**picture 1, enclosure 1**).
(see Fig.14,36,8 and Specification, page 8, line 3-8, P.10, line 1-7, page 14, line 23-33, page 16, line 21-25, page 18, line 5-11, line 23-29, claim 23,35,38,40,14,13 from June 13, 2000)
2. with the boundary surfaces intersecting each other, forming a corner (**picture 2, enclosure 1**)
(see Fig. 24,22,4,29,31, claims 11,12,14,15,18,32,34-40, Specification, page 7, line 19-22, page 7, line 26-28, if they form a corner edge)

In both cases, the boundary surfaces intersect each other, forming a corner (bordering- or corner edge 10). In both cases, the air coil at the edge (bordering- or corner edge 10) changes its geometrical form in the area of the intersection point of the boundary surfaces, like in

picture 1, enclosure 1 from a curved form into a straight form and in **picture 2, enclosure 1** from a straight form into a very short curved and again into a straight form.

Geometrical form means forms like a circular form, arcs, straight lines, circular arcs.

A machine with a bordering- or corner edge makes a change of direction of the air coil possible, in section across the moving direction, with the area of the coil side (running through the field-free space, in the transition region from one air coil section to the neighboring one) being very short. This means that losses (electrical and mechanical) are minimal, increasing the efficiency of the machine and giving the machine a favorable and compact form. This positive effect will be even bigger if arc-shaped (curved) air gap sections are used.

(Specification page 4, line 15-34, page 5, line 1-25, page 5, line 30-34, page 6, line 1-8, page 22, line 18-34, S.23, line 1-12)

At the **outer edge 28** not only neighboring air gap sections border at each other with their boundary surfaces directly (contacting each other directly, like the bordering- or corner edge), but also the boundary surfaces of the air gaps are relatively close to each other in the outer areas of the surfaces (Fukami (US 4,604,540) and Oba (JP 55-083,449) have them lying further apart) and are connected with a short edge (see outer edge 28). The air gap sections are positioned left and right to the outer edge. Fukami and Obi have the coil folded or curved around the outer edge, but it is outside the air gap resp. the air gap sections (**picture 3, enclosure 1**).

Concerning point 3:

The title of the invention has been changed to read:

Highly Efficient Electrical Machine With A Bent And/Or Folded Air Core Coil, Without Contact To Iron, Between Two Magnetic Bodies, in accordance with the requirement set forth by the Examiner.

Concerning point 5:

In claim 122 it must be “every coil side”.

The new claim 167 (old claim 124) was supplemented to provide an antecedent basis for the limitation (restriction) of claim 174 (old claim 127).

Concerning point 7:

The assessment of claim 122 is based on a misunderstanding concerning the air gap boundary surfaces (angular to each other), resp. the edge 10 (now outer edge 28).

This is not, as it was assumed by mistake, the whole boundary surface of the first body, but parts of this boundary surface, neighboring each other, each belonging to an air gap section. The characteristic feature of an air gap section is that it is formed out of two boundary surfaces facing each other, with a magnetic field between them, with at least one boundary surface with magnetic poles, of which the magnetization direction runs to the opposite boundary surface. In **picture 1, enclosure 1 dated April 17, 2003**, the areas between the air gap sections do not belong to the air gap. In **picture 3, enclosure 1** of this writing showing two parallel air gap sections connected by a short outer edge 28, the outer edge does not belong to the air gap as well. The same goes for the outer edges at Oba (JP 55-083,449), meaning the girth sides of the axial magnetized magnets. Looking at Fukami (US 4,604,540) we see the same; the neighboring boundary surfaces 18a and 18b (in fig. 6) are connected to each other by an outer edge, which is not penetrated by the field.

With the edge 10 in claim 122 a bordering and corner edge is meant, which is formed by the two neighboring boundary surfaces being positioned angular to each other.(concerning point 1)

The invention in claim 122 is new and inventive and not obvious for a person of ordinary skill. This means the machine can work highly efficient with two straight air gaps lying in a acute angle to each other, which include a lenticular first body and which is included in claim 200 (old claim 153). Further changes are described in the claims 202, 204, 205, 112, (old claims 155,157,158,164)).

The assessment of **claim 125** is based on a misunderstanding concerning the speed of the single coil sides. Here, it does not say that both coil sides have the same speed like under point 8 (Fukami (US 4,604,540)), but that there are sections within one coil side which have

the same speed, for example if they run on the same radius (as shown in fig.27). This is a very space-saving variant which includes a lot of conductor material in the high speed area, and that with a high effectiveness of the conductor in the coil. The invention in claim 125 is new and inventive and not obvious for a person of ordinary skill. (Specification, page 19, line 9-16, page 21, line 4-14)

The content of **claim 126** is known, but not in connection with the content of claim 124, which is also new and inventive.

Claim 144 has been expressed more clearly according to the suggestion in point 14.

Concerning point 8:

Concerning the claims 122, 125, 126, 144 see point 7.

Claim 127 is justified in connection with the invention in Claim 124.

Concerning point 10:

This is based on a misunderstanding about the edge 10, which is now described as an outer edge 28 more restrictively and more clearly.

Applicant objects to the assessment of the **claims 124 and 140**. Considering the new explanation of edge 10 as outer edge, the argumentation in the amendment dated 17th April 2003 is more than sufficient. Nevertheless Applicant wants to add some practical experience to underline how extraordinary the invention is.

Applicant has written several papers about this theme which have been reviewed by several scientists of the university (Scientific advisory board of specialist journals for electrical machines). The concept was not accepted as Applicant could not give any proofs for the high efficiency of the machine at that time. No one could image that an air gap machine like this could have a higher efficiency than machines which have iron-core coils (“Iron machines”). There is a big resistance to do without iron in a core to make a machine more efficient, because everyone is firmly fixed in their opinion that iron increases the tension by a factor of 1000-5000, as this is apparently proven by the μ_r (magnetic permeability) of iron to air. But this is just a distorted point of view. The benefits of the highly efficient coil utilization in general and with an axis approximation have been disputed as well, because the speed decreases with the radius and the conductor has to be prolonged for this. This argument has

been held up to Applicant during license negotiations with a manufacturer of bell-shaped machines. It has even been said that the output decreases in the fourth power to the radius. Such a lack of understanding and so little openness from specialists for this area – the decreasing of the speed has only a linear effect on current and tension. No one could imagine that avoiding a winding head and using only short conductors in the girth area of the machine leads to increasing the efficiency considerably. These are only a few examples that show how difficult it is, even for an expert, to accept this new concept, which is the basis for the patent application, and the respective machine. And these machines are not at all obvious for a person of ordinary skill.

Because of the many rejections Applicant has performed more detailed calculations which prove that, compared to common disc machines, an increased output of factor 11 can be reached with machine of the same diameter, only by using the machine in fig.1.

The active conductor parts increases by approx. 60% and compared to “iron machines” the losses of iron can be avoided as well. Machine substance can be saved and there are a couple of other advantages.

Using the short conductors in the girth area leads (as well as in Oba’s machine) to an output increase of 100%, hardly believable for a person of ordinary skill.

An axis approximation of the winding in an axial cylinder machine leads to an increased performance of approx. 60% and an improvement of the coil utilization of approx. 60% with the same machine diameter. Increased performance or output means here that all components (conductor, magnetic material, machine surface, machine volume, relative speed, weight, energy imparted) can be used highly efficient.

Inventive machines reach the same performance as iron machine with the same machine size, but much better machine characteristics, which means considerably higher efficiency.

This may seem totally incredible to an average expert. Only with a proof these experts are willing to deal with this theme. An increase of efficiency by such an unusual and weird concept may seem rather strange to an average expert. Never would he have the idea to combine the systems of Oba and Rabe to make a highly efficient electrical machine, because the knowledge about machines and the direction in which machines developed in the past 100 years points against it.

The machine concept was developed further in the meantime and applied to the area of asynchronous machines as well. The results are so amazing that it is possible that this

machine concept will renew the whole area of electrical machines, as it is the most efficient form of an electrical machine in which the ideal conditions are realized 100%. (see also concerning point 11)

Concerning point 11:

Objection concerning the comment about 146 (old claim 105) (if this comment is about claim 146). To make things more clear the claim was formulated according to claim 146 with markings or claim 25 dated June 13, 2000.

From US-5289069 (Hasegawa) we know that within an air gap of an air gap machine magnetic poles can be positioned on one or both sides. The invention in claim 146 is not mainly the fact that magnetic poles are positioned on both sides of a coil backed with a return path, but that the magnet in the girth area of a disc machine additionally uses the conductors in the folded region. This invention was until now unknown and is not obvious at all (see concerning point 10). Oba's machine (JP 55-083,449) can not easily be extended with such an outside magnet, as the magnet does not have a facing return path (like in fig.8 the return path flat strip 9) in part 11, resp. the facing magnet (like part 6 in fig.8, of which the magnet is magnetized in direction of the girth). The lines of electric flux mentioned in claim 146 would face the girth-side face regions of the inner magnets where they can not penetrate. This means that more than one step of development is necessary to turn Oba's machine into the invention in claim 146. Either an inner return path ring (belonging to part 11) is necessary as shown in fig. 4,5,7, or a magnet which is magnetized in the direction of the girth area as shown in fig. 8 or fig. 14. Apart from that, the problem concerning the coil frame does not have to be solved which Oba places in the girth area. An inventive solution is shown in fig.3,4,5 with coil frame 21.

The invention in claim 146 is justified in connection claim 145 and 124.

Concerning point 12:

Applicant objects to the assessment of claim 153 and 154 as it is based on a misunderstanding. It is about the build of the machines in the claims 122 (new claim 165) and 124 (new claim 167) as rotating machines. (see Point 7 and 10)

Concerning point 13:

In claim 122 the edge 10 was (restrictively) specified as bordering and corner edge, so that claim 122 can be granted and refers to claim 157 with its builds.

Concerning point 14:

Applicant attaches enclosure 1 referred to in the amendment filed April 17, 2003. The reason for the misunderstanding can be the following: The outer edge of the air gap is meant, which means its outer border in section across the moving direction and not outer edge 28 of the boundary surface.

This misunderstanding (see also concerning point 10) shows that the generic claims are not disclosed in the patents of Rabe and Oba.

2. Further changes in the new claims 165-212

2.1. New claims have been added:

2.1.1 New Claim 169

A solution to the task is creating a highly efficient synchronous machine equipped with at least one air gap alternating current winding, so that the average and high performance area (e.g. vehicle drives for a new car generation) have a highly efficient machine (lightweight, compact, high performance, better braking action in the rotor) as well. The basis of this invention is described in the Specification on page 4, lines 6-14, page 10, line 31-33, page 11, line 1-2, page 22, line 10-12, line 18-21.

Alternating current winding are only known as groove windings in iron. These are then actuated with alternating current or rotary current, the rotating field actuates a synchronous or asynchronous machine. Alternating current winding are only known as groove windings in iron. Apart from that, only drum windings are used here, as the inserting in the grooves of a pancake coil is not only very hard to do, but also almost impossible. Due to the high losses (iron- and copper losses) the efficiency of machines like that is rather low and the characteristics of the machine leave much to be desired. The machine surface utilization is rather small, too. Due to the

necessary iron tooth it is not possible to coat the whole air gap surface with copper. You can see alternating current winding in figs. 2,11,25,28,30,32,37.

2.1.2 New Claim 170

Claim 170 describes a solution to the task. The bent and folded coils with several windings allow for a high performance at low number of revolutions, the girth area can be used highly efficient as one- or two-layered direct current winding. The winding head conductors, which are often too long in common drum windings, overlap in the axis-near area and are shortened extremely due to the axis approximation. The machine makes a high dynamic ratio as coil rotor possible, as the overlapping winding heads in the girth area are not necessary, which means the coil has a low moment of inertia. Due to the overlapping of the machine surface and pole surface are used efficiently.

Here, the state of the art is applicable which was described for claim 169. Apart from that, this claim is also applicable for direct current windings which are not used in this form and are a big step in development.

(Specification page 13, line 6-18, Figs. 10,11,12,13)

2.1.3. New Claim 171

A solution to the task is described in claim 171. Here, single conductor coils are bent or folded around at least one first body and are, starting from the girth, approximated to the axis or shaft generally V-shaped. This makes a highly efficient two-layered winding in the girth area, of which the conductors can run perfectly right-angled to the girth area. Inactive conductor parts can only be in the axis-near area of the coil. This way a slanted winding can be used in a disc machine highly efficient for the first time. This was not possible until now, as the active pole surface is reduced in simple pancake coils with slanted conductors and are mainly active in the axis-near area. In known disc machines this negative effect was reduced by choosing involute coil courses in the girth- and axis-near areas. But there is the same problem which was solved by this invention.

(Specification page 11, line 30-35, page 12, line 6-13, page 13, line 6-11, Figs. 14,15)

2.1.2. New Claim 172

The new claim 172 describes the machine in claim 169 with a rotary current winding or a traveling-wave winding.

(Specification page 10, line 31-33, page 11, line 1-2, Figs. 36-38, page 22, line 10-12)

2.1.3. New Claim 204

For claim 204 see description page 17, last paragraph to page 18, first paragraph.

2.2. Old claims have been changed:

2.2.1. Claim 212

Claim 212 was extended a bit more than claim 164. Basis is claim 82 and claim 119 as well as descriptions on page 22, line 5-14.

2.2.2. Claim 203, 209,173,

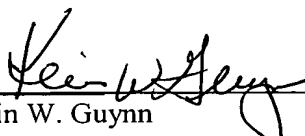
are changed to multiple dependent claims.

3. New Information from the European Patent Office

The claims presented herein have received favorable treatment at the European Patent Office, after misunderstandings regarding the invention were resolved.

Applicant respectfully submits that the new claims overcome the objections and rejections made by the Examiner and Applicant requests the Examiner to reconsider the rejections and to pass the application to issue.

Respectfully submitted,

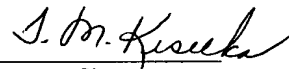

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